Remarks/Arguments

Claim Summary

By this Amendment, claims 1 and 33 have been revised.

Claims 1-2, 4-35 and 38 remain pending in the application.

35 USC 103

Claims 1-10, 13-18, 33-35 and 38 were rejected under 35 USC 103 as being obvious over Kawasaki et al. (US 4795529) in view of Beaudry (US 3569777) (identified by the Examiner as "Beaudry") for the reasons stated at pages 3-4 of the Office Action.

Claims 1-5, 19-25, 29-30 and 33-35 were rejected under 35 USC 103 as being obvious over Okudaira et al. (US 4985114) in view of Beaudry for the reasons stated at pages 4-6 of the Office Action.

Claims 11-12 were rejected under 35 USC 103 as being obvious over Kawasaki et al. in view of Beaudry, and further in view of Sadinsky (US 5424691) for the reasons stated at page 6 of the Office Action.

Claims 26-28 were rejected under 35 USC 103 as being obvious over Kawasaki et al. in view of Beaudry, and further in view of Leiphart (US 5882488) for the reasons stated at pages 6-7 of the Office Action.

However, again Applicants respectfully contend that Claims 1-30, 33-35 and 38 clearly define over the cited references, and in view of the following representations, reconsideration of the rejection under 35 USC 103 is requested.

As before, each of the rejections is commonly characterized by the Examiner's contention that one of ordinary skill would modify either one of Kawasaki et al. or Okudaira et al. to incorporate the impedance matching network of Beaudry.

As explained below, Applicants respectfully contend that:

1. One of ordinary skill would not incorporate the impedance matching circuit of Beaudry into Kawasaki et al. and Okudaira et al. in the fashion suggested by the Examiner; and
2. Even if the impedance matching circuit of Beaudry was somehow incorporated into Kawasaki et al. and Okudaira et al., the resultant combination would not correspond to the now pending claims.

These two contentions are discussed in reverse order below.

EVEN IF THE IMPEDANCE MATCHING CIRCUIT OF BEAUDRY WAS SOMEHOW INCORPORATED INTO KAWASAKI ET AL. AND OKUDAIRA ET AL., THE RESULTANT COMBINATION WOULD NOT CORRESPOND TO THE NOW PENDING CLAIMS.

As previously discussed in detail by Applicants, the apparatus of Beaudry is not adjustable or controllable after initial set-up. Instead, the impedance matching unit of Beaudry is constructed to have a generally low Q factor, which allows it to approximately match to a range of plasma conditions. Thus, Beaudry provides limited impedance matching by way of a non-adjustable construction which exhibits tolerance to (relatively small) changes in plasma impedance rather than being controllable to compensate for such impedance changes. Please see the detailed discussion of Beaudry contained at pages 10-12 of Applicant's response dated April 20, 2005.

In the most recent Office Action, the Examiner states:

> *" ... [Applicant's] argument is not persuasive because Beaudry's impedance matching network is provided for measuring the impedance mismatch during the plasma processing and would have been obvious to one of ordinary skill I the art at the time of the claimed invention to employ Beaudry's*

teaching despite the type of the plasma generation."

Applicant is unclear as to what the Examiner intends by this statement, and clarification is requested.

The apparatus of Beaudry does disclose the measurement of reflected power, and Applicant can only presume that it is this that the Examiner is referring to when stating that Beaudry measures the impedance mismatch. However, Beaudry does not teach using a measurement of impedance mismatch for any purpose. In particular, Beaudry does not teach utilizing a measurement of impedance mismatch in order to compensate for the impedance mismatch by adjusting a processing parameter or an apparatus parameter so as to stabilize the plasma. Note that the passage of Beaudry at column 1, lines 60-68 (discussed in sections 4 and 5 of the Office Action) refers to the prior art and not to the invention of Beaudry. In complete contrast, as noted above, the impedance matching unit of Beaudry utilizes only fixed and factory pre-set circuit components, and thus cannot be controlled in this manner.

It is readily apparent that hypothetical combinations of Beaudry and Kawaski et al., and Beaudry and Okudaira et al. would not produce a method falling within the scope of amended claims 1 and 33.

This is because amended claims 1 and 33 specify that the compensation for the impedance mismatch is by way of adjusting a processing parameter or apparatus parameter so as to stabilize the plasma during at least one of the defined transitions. Neither Beaudry nor Kawasaki nor Okudaira disclose such a method step. In particular, Beaudry does not disclose a compensation step: in contrast, Beaudry discloses a non-adjustable impedance matching unit which can exhibit tolerance to certain changes in plasma impedance by virtue of having a low Q factor. Therefore, even if the cited references were somehow combined in the manner put forward by the Examiner the resulting combination would not fall within the scope of claims 1 and 33.

ONE OF ORDINARY SKILL WOULD NOT INCORPORATE THE IMPEDANCE MATCHING CIRCUIT OF BEAUDRY INTO KAWASAKI ET AL. AND OKUDAIRA ET AL. IN THE FASHION SUGGESTED BY THE EXAMINER

It appears from the record that the present obviousness rejections have been made with hindsight, benefiting from the insight provided by the present application, which of course is not permissible.

The present invention concerns a particular, switch process in which alternate etching/deposition steps are performed cyclically (see page 1, line 13 to page 2, line 8). This process in particularly useful since it enables highly anisotropic etches to be performed allowing high aspect ratio trenches to be produced. Kawaski et al. and Okudaira et al. disclose examples of the cyclical, alternate etching/deposition technique.

The present invention stems from the insight that the cyclical, alternate etching/deposition technique suffers from a problem in the transition regions between the etching and deposition steps and from the deposition to etching steps. This problem is that the plasma impedance can vary rapidly and dramatically, leading to plasma instability or even extinguishing of the plasma (see, for example, page 13 of the present application). Kawasaki et al. and Okudaira et al. both teach the cyclical and alternating etching/deposition technique, but neither of these documents teach or even suggest that there may be a problem in the transition regions, let alone suggest what the solution might be.

In the meantime, Beaudry is wholly concerned with producing and sustaining a plasma in a single etching phase. Beaudry is not concerned with the cyclical, alternate etching/deposition technique, and does not disclose the above-mentioned problem at all. Thus, none of the cited prior art documents disclose or even suggest the fundamental problem addressed by the present invention, and so there would be no motivation whatsoever for the skilled person to combine these documents.

As noted above, the relatively large and rapid fluctuations in plasma impedance in the transition regions represents a particularly severe problem which was previously unrecognized in the prior art. The Applicant believes that, even if the impedance matching unit of Beaudry was introduced into the apparatus of Kawaski et al. and Okudaira et al. the resulting system would not be suitable for use in the cyclical, alternate etching/deposition process. In other words, the hypothetical combination suggested by the Examiner would not work. This is because the system of Beaudry is not suitable for coping with the potentially severe and rapid fluctuations in plasma impedance which occur in the transition regions.

Conclusion

No other issues remaining, reconsideration and favorable action upon the claims 1-2, 4-35 and 38 now pending in the application are requested.

Respectfully submitted,

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